DRIVER MODULE V2 (3U) TEST INSTRUCTIONS

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I. INTRODUCTION:

The Driver Module V2 is composed of three parts. The one is the digital circuit part that includes Digital Interface, Module Addressing, Control and Status Register (CSR) and Digital to Analog Converter (DAC). The second is the analog parts that consists six Analog Amplifier Channels, each of which have selectable Gain, Polarity as well as controllable DC input offset voltage with low noise performance. The last part includes the Precise Reference Voltage Generator and DC Power Control Circuit. A following tests for Driver Module V2, must be performed to verify proper operation. Basically, the test should check the Gain Accuracy, Slew Rate, Bandwidth and Input Voltage Noise with different Gain settings, Polarity and OFFSET for each analog channel. Meanwhile the measured data should be recorded in the test report form in the test process. All of data should be arranged later in order to create a final test report as a record for each module tested.

II. TEST EQUIPMENT REQUAREST:

1. Unix Computer with FLIP3UDRIVER.NEW.PL software
2. GPIB Interface
3. Controller Card
4. Subrack
5. CDMS Power Supply
6. Tectronix 2467B 400MHz Oscilloscope
7. HP 33120A 15 MHz Function/Arbitrary Waveform Generator
8. SR770 FFT Network Analyzer
9. HP E3631A Triple Output DC Power Supply
10. Multimeter
11. Data Write and Read Board (Special made for test Driver Module V2), see figure 1 below.
12. Extend Card for subrack

III. TEST PROCEDURE:

<u>1. PRELIMINARY TEST:</u>

The purpose of this test is to check the basic function of the unit under test. If any problem is found, it should be fixed and before continuing the test.

A. TEST SETUP:

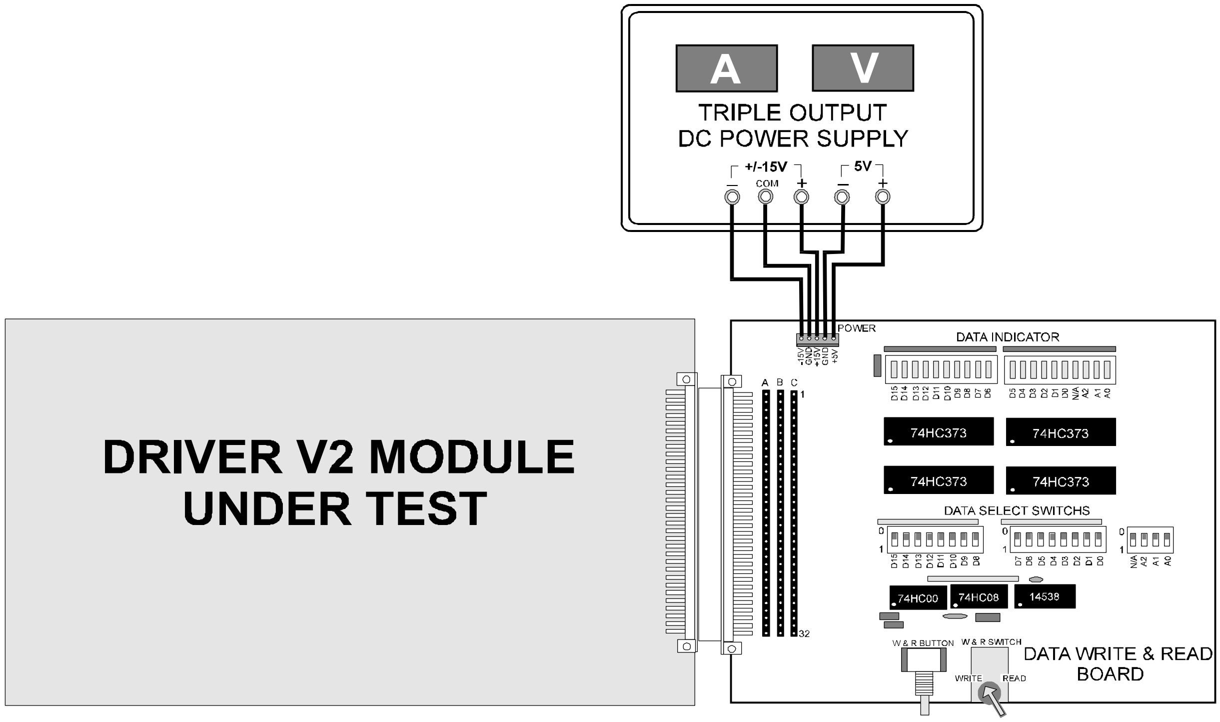

Figure1: Preliminary Test Setup

B. DC POWER:

Turn on the Triple Output DC Power Supply.

Verify the five DC power LEDs should light up approximate 0.3 seconds after the DC power is applied.

Observe that the current drawn from the +5V DC power supply does not exceed 50 mA, the current drawn from +15V power supply does not exceed 300 mA and the current drawn from -15V power supply should be less than 200 mA.

C. CHECK THE REFERENCE VOLTAGES:

Use the multimeter to check the +/- 10V and +/- 5V reference voltages. The readings of multimeter should be:

+5.00 +/- 0.01V at pin 3 of U128,
-5.00 +/- 0.01V at pin 14 of U128,
+10.00 +/- 0.02V at pin 1 of U124 and
-10.00 +/- 0.02V at pin 1 of U125.

D. WRITE AND READ DATA TO/FROM CSR:

Set the Address Selection Switch on Driver V2 board to 0110(b).

To write data into CSR0, set Address Lines A(2:0) to 011(b) and Data Lines D(15:0) to 7FFF(h) on the Data Write & Read board. Place the “W & R Switch” to “WRITE” position then push the “W & R Button”. The Data 7FFF(h) should be written into CSR0 of the Driver board under test.

To read data from CSR0, keep the A(2:0) = 011(b). Switch the “W & R Switch” to “READ” position and push “W & R Button” again. The Data Indicator on the Data W & R board should then display 7FFF(h), the status read back from CSR0.

Set D(15:0) to 0000(h) repeat write and read data to/from CSR0 and verify the new status, 0000(h) of CSR0, should be read back and displayed on the Data Indicator.

To write and read data to/from CSR1, set A(2:0) to 111(b) and repeat the steps above.

Observe the Module Addressed LED on the front panel of the Driver V2 under test. It should flash once while pushing the “W & R Button”.

E. WRITE AND READ DATA TO/FROM DAC:

To write and read data into/from DAC0 (U126), set A(2:0) = 000(b) for Channel 0 [A(2:0) = 001(b) for CH1, A(2:0) = 010(b) for CH2] and D(11:0) = FFF(h). Put the “W & R Switch” to “WRITE” position then push the “W & R Button”.

To read data from DAC0, Keep A(2:0) = 000(b) . Switch “W & R Switch” to “READ” position and push the “W & R Button”, The Data Indicator on the Data W & R board should then display FFF(h), the status read back from DAC0 for CH0.

Using a multimeter to check the VoutA of DAC0 at pin 3 of U126 (pin2 for CH1, pin 27 for CH2). The reading should be +5.00V.

Set D(11:0) = 800(h) and repeat steps above. The reading of multimeter should be 0.00V

Set D(11:0) = 000(h) and execute write and read once again, then verify the output voltage is -5.00V.

Repeat steps above for CH1 and CH2.

To write and read data to/from DAC1 (U127), set A(2:0) = 100(b) for CH3 [A(2:0) = 101(b) for CH4 and A(2:0) = 101(b) for CH5]. Then repeat these steps above for CH3, CH4 and CH5.

F. CHECK THE AMPLIFIER FUNCTIONS FOR EACH CHANNEL:

To check the functions of the amplifier, leave the input of amplifier open and connect a 50 ohm resistor between the analog output of amplifier under test and ground. Apply the offset voltage as the input signal. Using the following setup to select GAIN and POLARITY for different channels. Then test the output voltage with a multimeter. The voltage reading should be close to (Voffset * GAIN) and the polarity of output will depend on which polarity is selected. The amplifier configuration selected for the test setup on the Data W & R Board should be written into Driver board under test by setting the "W & R Switch" to "WRITE" position and then pressing the "W & R Button".

The test setup:

For Channel 0:

a) Set GAIN = 1, POLARITY = Positive: D(15:0) = 0000(h), A(2:0) = 011(b);
Select the Voffset0 = +5.00V by setting D(15:0) = 0FFF(h), A(2:0) = 000(b), then verify Vout0 = -5.00V.

b) Set GAIN = 1, POLARITY = Negative: D(15:0) = 1000(h), A(2:0) = 011(b);
Keep Voffset0 = +5.00V, then verify Vout0 = +5.00V.

c) Set GAIN = 1.43, POLARITY = Positive: D(15:0) = 0001(h), A(2:0) = 011(b);
Select the Voffset0 = +3.00V by setting D(15:0) = 0CCC(h), A(2:0) = 000(b), then verify Vout0 = -4.30V.

d) Set GAIN = 2, POLARITY = Positive: D(15:0) = 0002(h), A(2:0) = 011(b);
Select the Voffset0 = +2.00V by setting D(15:0) = 0B33(h), A(2:0) = 000(b), then verify Vout0 = -4.00V.

e) Set GAIN = 5, POLARITY = Positive: D(15:0) = 0003(h), A(2:0) = 011(b);
Select the Voffset0 = +1.00V by setting D(15:0) = 0999(h), A(2:0) = 000(b), then verify Vout0 = -5.00V.

f) Set GAIN = 10, POLARITY = Positive: D(15:0) = 0004(h), A(2:0) = 011(b);
Select the Voffset0 = +0.50V by setting D(15:0) = 08CC(h), A(2:0) = 000(b), then verify Vout0 = -5.00V.

g) Set GAIN = 14.3, POLARITY = Positive: D(15:0) = 0005(h), A(2:0) = 011(b);
Select the Voffset0 = +0.30V by setting D(15:0) = 087B(h), A(2:0) = 000(b), then verify Vout0 = -4.30V.

h) Set GAIN = 20, POLARITY = Positive: D(15:0) = 0006(h), A(2:0) = 011(b);
Select the Voffset0 = +0.20V by setting D(15:0) = 0851(h), A(2:0) = 000(b), then verify Vout0 = -4.00V.

i) Set GAIN = 50, POLARITY = Positive: D(15:0) = 0007(h), A(2:0) = 011(b);
Select the Voffset0 = +0.10V by setting D(15:0) = 0829(h), A(2:0) = 000(b), then verify Vout0 = -5.00V.

For Channel 1:

a) Set GAIN = 1, POLARITY = Positive: D(15:0) = 0000(h), A(2:0) = 011(b);
Select the Voffset1 = +5.00V by setting D(15:0) = 0FFF(h), A(2:0) = 001(b), then verify Vout1 = -5.00V.

b) Set GAIN = 1, POLARITY = Negative: D(15:0) = 2000(h), A(2:0) = 011(b);
Keep Voffset1 = +5.00V, then verify Vout1 = +5.00V.

c) Set GAIN = 1.43, POLARITY = Positive: D(15:0) = 0010(h), A(2:0) = 011(b);
Select the Voffset1 = +3.00V by setting D(15:0) = 0CCC(h), A(2:0) = 001(b), then verify Vout1 = -4.30V.

d) Set GAIN = 2, POLARITY = Positive: D(15:0) = 0020(h), A(2:0) = 011(b);
Select the Voffset1 = +2.00V by setting D(15:0) = 0B33(h), A(2:0) = 001(b), then verify Vout1 = -4.00V.

e) Set GAIN = 5, POLARITY = Positive: D(15:0) = 0030(h), A(2:0) = 011(b);
Select the Voffset1 = +1.00V by setting D(15:0) = 0999(h), A(2:0) 001(b), then verify Vout1 = -5.00V.

f) Set GAIN = 10, POLARITY = Positive: D(15:0) = 0040(h), A(2:0) = 011(b);
Select the Voffset1 = +0.50V by setting D(15:0) = 08CC(h), A(2:0) = 001(b), then verify Vout1 = -5.00V.

g) Set GAIN = 14.3, POLARITY = Positive: D(15:0) = 0050(h), A(2:0) = 011(b);
Select the Voffset1 = +0.30V by setting D(15:0) = 087B(h), A(2:0) = 001(b), then verify Vout1 = -4.30V.

h) Set GAIN = 20, POLARITY = Positive: D(15:0) = 0060(h), A(2:0) = 011(b);
Select the Voffset1 = +0.20V by setting D(15:0) = 0851(h), A(2:0) = 001(b), then verify Vout1 = -4.00V.

i) Set GAIN = 50, POLARITY = Positive: D(15:0) = 0070(h), A(2:0) = 011(b);
Select the Voffset1 = +0.10V by setting D(15:0) = 0829(h), A(2:0) = 001(b), then verify Vout1 = -5.00V.

For Channel 2:

a) Set GAIN = 1, POLARITY = Positive: D(15:0) = 0000(h), A(2:0) = 011(b);
Select the Voffset2 = +5.00V by setting D(15:0) = 0FFF(h), A(2:0) = 010(b), then verify Vout2 = -5.00V.

b) Set GAIN = 1, POLARITY = Negative: D(15:0) = 4000(h), A(2:0) = 011(b);

Keep Voffset2 = +5.00V, then verify Vout2 = +5.00V.
c) Set GAIN = 1.43, POLARITY = Positive: D(15:0) = 0100(h), A(2:0) = 011(b);
Select the Voffset1 = +3.00V by setting D(15:0) = 0CCC(h), A(2:0) = 010(b), then verify Vout2 = -4.30V.
d) Set GAIN = 2, POLARITY = Positive: D(15:0) = 0200(h), A(2:0) = 011(b);
Select the Voffset2 = +2.00V by setting D(15:0) = 0B33(h), A(2:0) = 010(b), then verify Vout2 = -4.00V.
e) Set GAIN = 5, POLARITY = Positive: D(15:0) = 0300(h), A(2:0) = 011(b);
Select the Voffset2 = +1.00V by setting D(15:0) = 0999(h), A(2:0) = 010(b), then verify Vout2 = -5.00V.
f) Set GAIN = 10, POLARITY = Positive: D(15:0) = 0400(h), A(2:0) = 011(b);
Select the Voffset2 = +0.50V by setting D(15:0) = 08CC(h), A(2:0) = 010(b), then verify Vout2 = -5.00V.
g) Set GAIN = 14.3, POLARITY = Positive: D(15:0) = 0500(h), A(2:0) = 011(b);
Select the Voffset2 = +0.30V by setting D(15:0) = 087B(h), A(2:0) = 010(b), then verify Vout2 = -4.30V.
h) Set GAIN = 20, POLARITY = Positive: D(15:0) = 0600(h), A(2:0) = 011(b);
Select the Voffset2 = +0.20V by setting D(15:0) = 0851(h), A(2:0) = 010(b), then verify Vout2 = -4.00V.
i) Set GAIN = 50, POLARITY = Positive: D(15:0) = 0700(h), A(2:0) = 011(b);
Select the Voffset2 = +0.10V by setting D(15:0) = 0829(h), A(2:0) = 010(b), then verify Vout2 = -5.00V.

For Channel 3:
a) Set GAIN = 1, POLARITY = Positive: D(15:0) = 0000(h), A(2:0) = 111(b);
Select the Voffset3 = +5.00V by setting D(15:0) = 0FFF(h), A(2:0) = 100(b), then verify Vout3 = -5.00V.
b) Set GAIN = 1, POLARITY = Negative: D(15:0) = 1000(h), A(2:0) = 111(b);
Keep Voffset3 = +5.00V, then verify Vout3 = +5.00V.
c) Set GAIN = 1.43, POLARITY = Positive: D(15:0) = 0001(h), A(2:0) = 111(b);
Select the Voffset03= +3.00V by setting D(15:0) = 0CCC(h), A(2:0) = 100(b), then verify Vout3 = -4.30V.
d) Set GAIN = 2, POLARITY = Positive: D(15:0) = 0002(h), A(2:0) = 111(b);
Select the Voffset3 = +2.00V by setting D(15:0) = 0B33(h), A(2:0) = 100(b), then verify Vout3 = -4.00V.
e) Set GAIN = 5, POLARITY = Positive: D(15:0) = 0003(h), A(2:0) = 111(b);
Select the Voffset3 = +1.00V by setting D(15:0) = 0999(h), A(2:0) = 100(b), then verify Vout3 = -5.00V.
f) Set GAIN = 10, POLARITY = Positive: D(15:0) = 0004(h), A(2:0) = 111(b);
Select the Voffset3 = +0.50V by setting D(15:0) = 08CC(h), A(2:0) = 100(b), then verify Vout3 = -5.00V.
g) Set GAIN = 14.3, POLARITY = Positive: D(15:0) = 0005(h), A(2:0) = 011(b);
Select the Voffset3 = +0.30V by setting D(15:0) = 087B(h), A(2:0) = 100(b), then verify Vout3 = -4.30V.
h) Set GAIN = 20, POLARITY = Positive: D(15:0) = 0006(h), A(2:0) = 111(b);
Select the Voffset3 = +0.20V by setting D(15:0) = 0851(h), A(2:0) = 100(b), then verify Vout3 = -4.00V.
i) Set GAIN = 50, POLARITY = Positive: D(15:0) = 0007(h), A(2:0) = 111(b);
Select the Voffset3 = +0.10V by setting D(15:0) = 0829(h), A(2:0) = 100(b), then verify Vout3 = -5.00V.

For Channel 4:
a) Set GAIN = 1, POLARITY = Positive: D(15:0) = 0000(h), A(2:0) = 111(b);
Select the Voffset4 = +5.00V by setting D(15:0) = 0FFF(h), A(2:0) = 101(b), then verify Vout4 = -5.00V.
b) Set GAIN = 1, POLARITY = Negative: D(15:0) = 2000(h), A(2:0) = 111(b);
Keep Voffset4 = +5.00V, then verify Vout4 = +5.00V.
c) Set GAIN = 1.43, POLARITY = Positive: D(15:0) = 0010(h), A(2:0) = 111(b);
Select the Voffset4 = +3.00V by setting D(15:0) = 0CCC(h), A(2:0) = 101(b), then verify Vout4 = -4.30V.
d) Set GAIN = 2, POLARITY = Positive: D(15:0) = 0020(h), A(2:0) = 111(b);
Select the Voffset4 = +2.00V by setting D(15:0) = 0B33(h), A(2:0) = 101(b), then verify Vout4 = -4.00V.
e) Set GAIN = 5, POLARITY = Positive: D(15:0) = 0030(h), A(2:0) = 111(b);
Select the Voffset4 = +1.00V by setting D(15:0) = 0999(h), A(2:0) = 101(b), then verify Vout4 = -5.00V.
f) Set GAIN = 10, POLARITY = Positive: D(15:0) = 0040(h), A(2:0) = 111(b);
Select the Voffset4 = +0.50V by setting D(15:0) = 08CC(h), A(2:0) = 101(b), then verify Vout4 = -5.00V.
g) Set GAIN = 14.3, POLARITY = Positive: D(15:0) = 0050(h), A(2:0) = 111(b);
Select the Voffset4 = +0.30V by setting D(15:0) = 087B(h), A(2:0) = 101(b), then verify Vout4 = -4.30V.
h) Set GAIN = 20, POLARITY = Positive: D(15:0) = 0060(h), A(2:0) = 111(b);
Select the Voffset4 = +0.20V by setting D(15:0) = 0851(h), A(2:0) = 101(b), then verify Vout4 = -4.00V.
i) Set GAIN = 50, POLARITY = Positive: D(15:0) = 0070(h), A(2:0) = 111(b);
Select the Voffset4 = +0.10V by setting D(15:0) = 0829(h), A(2:0) = 101(b), then verify Vout4 = -5.00V.

For Channel 5:
a) Set GAIN = 1, POLARITY = Positive: D(15:0) = 0000(h), A(2:0) = 111(b);
Select the Voffset5 = +5.00V by setting D(15:0) = 0FFF(h), A(2:0) = 110(b), then verify Vout5 = -5.00V.
b) Set GAIN = 1, POLARITY = Negative: D(15:0) = 4000(h), A(2:0) = 111(b);
Keep Voffset5 = +5.00V, then verify Vout5 = +5.00V.

c) Set GAIN = 1.43, POLARITY = Positive: D(15:0) = 0100(h), A(2:0) = 111(b);
Select the Voffset5 = +3.00V by setting D(15:0) = 0CCC(h), A(2:0) = 110(b), then verify Vout5 = -4.30V.
d) Set GAIN = 2, POLARITY = Positive: D(15:0) = 0200(h), A(2:0) = 111(b);
Select the Voffset5 = +2.00V by setting D(15:0) = 0B33(h), A(2:0) = 110(b), then verify Vout5 = -4.00V.
e) Set GAIN = 5, POLARITY = Positive: D(15:0) = 0300(h), A(2:0) = 111(b);
Select the Voffset5 = +1.00V by setting D(15:0) = 0999(h), A(2:0) 110(b), then verify Vout5 = -5.00V.
f) Set GAIN = 10, POLARITY = Positive: D(15:0) = 0400(h), A(2:0) = 111(b);
Select the Voffset5 = +0.50V by setting D(15:0) = 08CC(h), A(2:0) = 110(b), then verify Vout5 = -5.00V.
g) Set GAIN = 14.3, POLARITY = Positive: D(15:0) = 0500(h), A(2:0) = 111(b);
Select the Voffset5 = +0.30V by setting D(15:0) = 087B(h), A(2:0) = 110(b), then verify Vout5 = -4.30V.
h) Set GAIN = 20, POLARITY = Positive: D(15:0) = 0600(h), A(2:0) = 111(b);
Select the Voffset5 = +0.20V by setting D(15:0) = 0851(h), A(2:0) 110(b), then verify Vout5 = -4.00V.
i) Set GAIN = 50, POLARITY = Positive: D(15:0) = 0700(h), A(2:0) = 111(b);
Select the Voffset5 = +0.10V by setting D(15:0) = 0829(h), A(2:0) = 110(b), then verify Vout5 = -5.00V.

G. CHECK SYSTEM RESET:

Power up reset:

a) Power off the unit under test and then power up again by using the power supply ON-OFF switch.

b) Read the status of CSR0 (CSR1) by setting A(2:0) = 011 [A(2:0) = 111(b) for CSR1] , "W & R Switch" to "READ" position and then pressing "W & R Button". The Data Indicator should display 0000(h) for both CSR0 and CSR1.

c) Read the DAC data by setting the correspondent A(2:0) values for each channel. The Data Indicator should display
0800(h) for each channel.

System reset:

a) Write 7FFF(h) into both CSR0 and CSR1, then write FFF(h) into DAC0 and 000(h) into DAC1 by following the instructions described in steps D and E.

b) Set D(15:0) = 8000(h) and A(2:0) = 111(b), then push the "W & R Button" with the "W & R Switch" on the "WRITE" position.

c) Repeat the step b) and c) above.

2. FINAL TEST:

To make sure the Driver V2 module works properly and meets the specifications, a final test is necessary . In this test, all measured data taken from the unit under test must be recorded in the original Test Report Form. The data will be processed later in order to know the characters of the Driver module under test by checking and analyzing them.

A. TEST STATION SETUP:

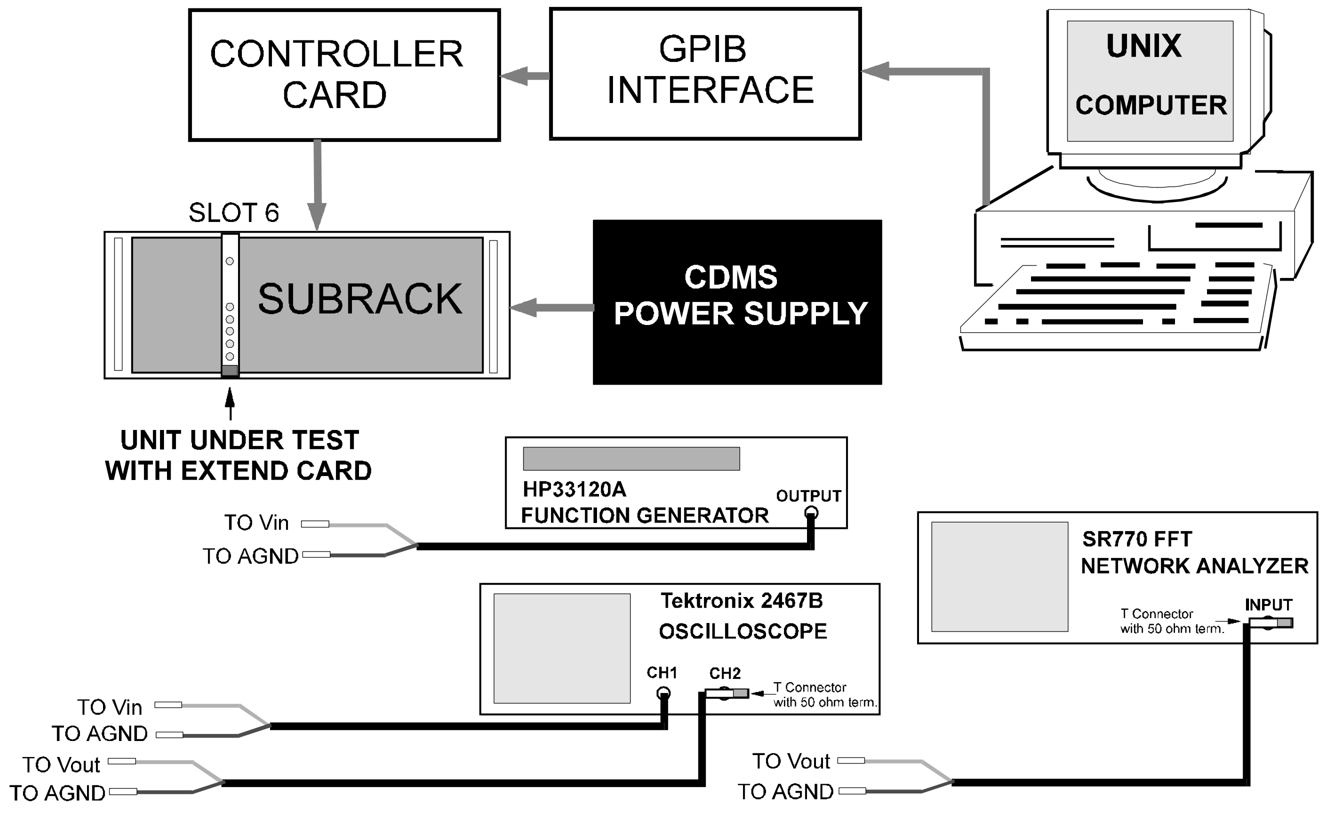

Figure2: Test Station for the Final Test

Insert the Driver V2 module to be tested into slot 6 with an extend card and power up. Warm up the unit under test for 15 minutes prior to starting the following test.

B. LOGIN THE COMPUTER:

To login the computer , follow the steps below:

a) Power up computer and wait for the Window to appear.
b) In the Service Box, type in **fnpx19**. Then click the **OK** button.
c) The following prompt should appear:
   login:
   After the "login:" prompt appears, type in **cdmsuser**.
   The following prompt should appear next:
   Password:
   Then type in **#kryostat** for the password.
d) The following will appear:
   cdmsuser>0%
   Then type in **cd perl**.
e) The following prompt should appear:
   cdmsuser>0%
   Type in **f3udriver.pl** command.
f) The work directory will change to "perl" and the following prompt should appear:
   perl:
   Next type in **help** at the "perl:" prompt and the "f3udriver help menu" will appear.
g) From here type in the commands needed to setup the Driver board under test in the test process.

C. OFFSET TEST:

In this test, leave the analog input open, connect a 50 ohm terminal from the analog output to ground and then use the multimeter to measure the output voltage.

a) Select Channel0:
   Set POLARITY = Positive and GAIN = 1.

Set the OFFSET to +5.00V, +2.00V, 0.00V, -2.00V and -5.00V. Measure the corresponding output voltage at the Vout0.

b) Change the POLARITY to Negative and repeat the step above.

c) Repeat steps a) and b) for all other channels.

D. GAIN TEST:

Connect a 10KHz sine wave signal from the HP 33120A Function Generator to the analog input of the amplifier under test. Connect the analog output of the amplfier connects to the CH2 input of the oscilloscope with a 50 ohm termination, then use the ΔV function to get the voltage reading.

a) Select Channel0:

Set POLARITY = Positive and OFFSET = 0.00V.

Set GAIN = 1, adjust the amplitude of the input sine wave on the function generator and observe the output signal displayed on the scope. The amplitude of analog output should always remain 5Vp-p (swinging between +/- 2.5V). Then take the reading for the amplitude of input signal from the HP 33120A Function Generator.

(When a function generator without the amplitude value displayed is used for the input signal, the CH1 input of the scope should be connected to the amplifier analog input in order to get the amplitude value of the input signal.)

b) Repeat step a) for each GAIN.

c) Repeat steps a) and b) for all other channels.

E. (-3 dB) BANDWIDTH TEST:

The test connection is same with step B.

a) Select Channel0:

Set POLARITY = Positive and OFFSET = 0.00V.

Set GAIN = 1.

Set the input signal to 10 KHz sine wave and adjust its amplitude to keep the output displayed on the scope with the amplitude of 5Vp-p.

Increase the frequency of the input signal (keeping the input amplitude constant) and monitor the output amplitude on the screen simultaneously until the output amplitude reaches 0.707 times of 5Vp-p (3.54Vp-p). This is the high frequency 3dB response of the amplifier under test and then read the frequency value from digital indicator on the generator.

b) Repeat step a) for each GAIN.

c) Repeat steps a) and b) for all other channels.

F. RISE, FALL AND DELLAY TIME TEST:

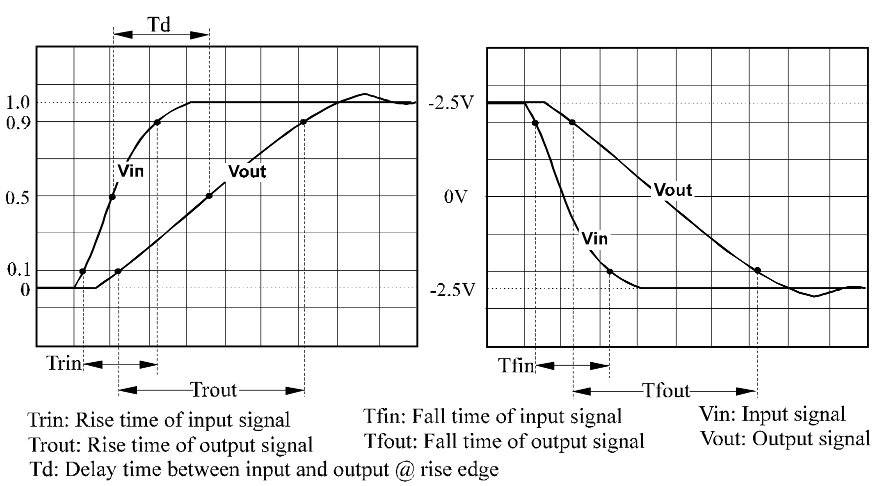

Figure3: Tr, Tf and Td test waveforms

Connect 10 KHz square wave signal from HP33120A Function Generator to the analog input of the amplifier under test. Connect the analog output of the amplifier to CH2 of the oscilloscope with a 50 ohm termination. To display the input signal on the screen at same time, CH1 of the scope is then connected to the analog input of the amplifier also. To obtain a more precise time reading, the Δt function is used to measure the time values to be tested. The sweep speed of the scope should be set to 50nS/Div or faster.

a) Select Channel0:

Set POLARITY = Positive and OFFSET = 0.00V.

Set GAIN = 1, adjust the amplitude of input square signal on the function generator and observe the output signal displayed on the screen. Make sure that the amplitude of the analog output should always keep 5Vp-p.

On the scope side, set the "Trigger Source" to CH1, "Trigger Coupling" to DC and adjust the Trigger Level close to 0.00V. Then set "+" slope to measure the Rise Time Tr and Delay Time Td, "-" slope for the Fall time Tf .

b) Repeat step a) for each GAIN.
c) Repeat steps a) and b) for all other channels.

G. NOISE MEASUREMENTS:

Leave all analog inputs open and connect the input of SR770 FFT Network Analyzer to the analog output of the amplifier under test with a 50 ohm terminal. The measured results in this step should be stored in a floppy disc by taking advantage of STARE data function in the SR770 Analyzer.

a) Settings for the SR770 FFT Network Analyzer:

Power up SR770 FFT Analyzer and wait until the Power-on tests are completed. Press "FREQ" to display the Frequency Menu, set the "Span" to 100 KHz, "Start freq" to 0.00Hz and "Linewidth" to 250 Hz by pressing "SPAN UP", "SPAN DOWN" button or using the knob. Press "MEAS" to display the Measure Menu, press "PSD" to select Power Spectral Density, press "Return" then "Units Menu" and select "Volts RMS".

b) Measure the Reference Noise.

Power off the Driver board under test. Then press "AUTU RANGE" to let the analyzer automatically set its input range to the actual signal, and hit "AUTO SCALE" button to set the graph scaling to display the entire range of the data.

The data and graph displayed on the screen is the reference noise. To store these data in a floppy disc. Insert a disc with the IBM format into the disc driver of the Analyzer. Press "STORE RECALL" and select "Save data". Hit "File name" and type REF as the file name and hit "Enter", then press "Save Ascii" to save these data as a Ascii file with a file name REF.

c) Power up the Driver board and wait for a few minutes to warm up.
Select Channel0.
Set GAIN = 1, POLARITY = Positive and OFFSET = 0.00V.
Press "AUTU RANGE" and "AUTO SCALE" again.
Store the results into the floppy disc with a file name "1010".

Note: Typically the file name consists of four digits. The first digit means the board number under test. Here is the #1 Driver board under test, for example. The middle two digits represent the GAIN selected and the last digit is the current Channel number.

d) Repeat step c) for GAIN = 10 and 50.
e) Repeat steps c) and d) for all other channels.

H. SIGN AND DATE THE TEST REPORT FORM:

When the entire tests are finished, the test report form should de signed and dated by the person who performed the tests.

VI. MEASURED DATA PROCESS AND CREATION OF THE FINAL REPORTS:

The measured data taken from the test procedure should be processed in order to create the final reports of the measurements. The characteristics of the Driver module tested can be determined through the final reports and verified with design specifications.

The final test report forms are created in Microsoft Excel. Some calculations with the data can be executed automatically by Microsoft Excel.

1. CREATE THE FINAL TEST REPORT FORM:

Open the file TstRpt.xls on the PC computer that includes the test report files. It has the same format sa the original one that is used to record the measured data during the test process. Then type the data into the corresponding blanks of the opened TstRpt.xls file.

A. CHECK THE RESULTS OF THE OFFSET TEST:

Using the following equations to calculate the accuracy (ACCoff) of the output voltage (Vout) with the Offset as a input voltage (Vin).

For Positive Polarity:

$$ACC_{off} = \frac{-(V_{out}) - V_{off}}{V_{off}} \times 100\%$$

For Negative Polarity:

$$ACC_{off} = \frac{V_{out} - V_{off}}{V_{off}} \times 100\%$$

Check that all ACCoff should meet: ACCoff =< +/-5%

B. CHECK THE RESULTS OF THE GAIN TEST

Using the following equation to calculate the accuracy (ACCg) of GAIN.

$$ACCg = \frac{V_{out}/Vin - GAIN}{GAIN} \times 100\%$$

Check that all ACCg should meet: ACCg =< +/-5%

C. CHECK THE RESULTS OF THE BANDWIDTH TEST:

Check that all bandwidth (-3dB) should >= 1.00 MHz.

D. CHECK THE RESULTS OF THE RISE, FALL AND DELAY TIMES TEST:

The high frequency characteristics of the amplifier under test can be presented by the BANDWIDTH. So the Rise, fall and delay times are just used as the references for the speed characteristics of the amplifier under test.

Using following equation to calculate the SLEW RATE.

$$\text{SLEW RATE} = \frac{V_{out}}{Tr} \quad (V/\mu s)$$

Here, the rise time of the input signal is ignored.

2.CREATE THE RESULTS OF NOISE MEASUREMENTS:

The data of the noise measurements have been stored in a floppy disc by using the Store Function of SR770 FFT Network Analyzer during the noise test process. There are total 400 data was taken for each noise measurement. Because of the Noise is a random variable, therefore he Arithmetic Mean and Mean Root Square values are used to present the Noise value precisely.

A: CALCULATE THE ARITHMETIC MEAN AND MEAN ROOT SQUARE VALUS FOR THE INPUT NOISE VOLTAGE:

Insert the noise measurements disc created by SR770 analyzer during the noise test into the floppy driver of a PC computer. Open one file on this disc, for example 1010, that stores the noise data taken from one noise measurement, for example the data was taken from the noise test for board 1, Channel 0 with the GAIN = 1. Then pick up all data into the Excel file and divide them in two columns that one column, for example column A, is filled by the FREQ, the frequency values, and another, for example column C, filled by Vnouti, the measured noise values. Each column has 400 cells with data filled.

The measured noise data taken by SR770 analyzer are the output noise voltages (Vnouti) with the reference noise (Vnrefi) included. They should subtract the reference noise (Vnrefi) and then transform to the Input Noise Voltage (Vni).

In the current working Excel file. Select another column with 400 blank cells, for example column B, to be filled out by Vni, the Input Noise Voltage values relative to the Vnouti. The Vni can be calculated by the following equation.

$$Vni = \frac{\sqrt{Vnouti^2 - Vnrefi^2}}{GAIN} \quad (nV/rtHz)$$

Where i = 0 - 400, the times of data taking in one noise measurement.

Select a blank cell on the current file, for example the cell below the last cell of the column Vni , then fill out this cell by Vn, the Arithmetic Mean Value of the input voltage noise, that calculated by the following equation.

$$Vn = \frac{\sum_{i=1}^{400} Vni}{400} \quad (nV/rtHz)$$

Select another blank cell that will be filled by the ΔVn, the Mean Root Square value of the input voltage noise, that is calculated by the following equation.

$$\Delta Vn = \sqrt{\frac{\sum_{i=1}^{400} (Vni - Vn)^2}{400 - 1}} \quad (nV/rtHz)$$

Using the value of (Vn +/- ΔVn) to fill out the corresponding blank of the Input Voltage Noise test results table in the Final Test Report Form.

B. CREATE THE GRAPH CHART OF FREQUENCY VS INPUT VOLTAGE NOISE VALUES:

Using the Insert Chart function of Excel to create the Graph of frequency vs input voltage noise on the current file. The data to be selected to create the graph are FREQ, the frequency column, for the X axis and Vn, the input voltage noise, for the Y axis. Then Insert the Chart Title, Value (Y) Axis and Category (X) Axis in the created chart and save this Noise Data file with its own file name, for example using file name 1010.xls for the noise measurement for board 1 and channel 0 with Gain = 1.

C. REPEAT STEPS A AND B FOR ALL NOISE MEASUREMENTS:

Following the steps A and B to create the Noise Data Excel files for all noise measurement for each channel with selected Gain. Then save them with their own file name.

D. CHECH THE RESULTS OF NOISE MEASUREMENTS:

Check all (Vn +/- ΔVn) values and they should meet that:
When GAIN = 1, (Vn +/- ΔVn) =< 20 nV/rtHz,
When GAIN = 10, (Vn +/- ΔVn) =< 8 nV/rtHz,
When GAIN = 50, (Vn +/- ΔVn) =< 8 nV/rtHz.

E. CREAT THE FINAL RESULTS OF THE NOISE MEASUREMENTS FOR ONE DRIVER V2 MODULE:

In the Excel work environment , open the NoisMsrRst.xls file or a new Excel worksheet file. Then copy all frequency, input voltage noise data and the graphs from the noise data files created in the steps A, B and C into the current Excel file by the order of channel 0, Gain = 1, then Gain = 10, then Gain = 50.. ..channel 5, Gain = 1, 10 and 50.

This is the final results of noise measurements for a whole board. Save it with a file name including the board number to be tested, for example BD1Noise.xls for the Driver board 1.

This file is able to be printed out if necessary. It is useful for analyzing the noise situations.